Integration of field survey and VHR satellite data analysis for the debris-flow hazard assessment in the Machu Picchu area

Geophysical Research Abstracts, Vol. 7, 03346, 2005
SRef-ID: 1607-7962/gra/EGU05-A-03346

Integration of field survey and VHR satellite data analysis for the debris-flow hazard assessment in the Machu Picchu area

N. Casagli, **R. Fanti**. M. Nocentini, G. Righini
University of Firenze, Earth Sciences Department, Firenze, Italy (rfanti@geo.unifi.it)

Machu Picchu, a symbol of the human civilization, is a very interesting site for the assessment of landslide hazard in weathered materials: the characteristics of climate and outcropping rocks determine the condition for the debris instability, revealed by fast landslides of various dimensions. Since 1997 the area has been in the spotlight for its slope instability, when Carreno & Bonnard described the general geological and geomorphological condition, and the further studies of Sassa et al. (2000, 2001, 2002) contributed to define the interpretation of the structures, as the result of the existence of a main deep slow slide involving the archaeological area. However, the attention of these studies focused on the condition of the entire slope, with a lesser consideration for the shallow landslides, even if debris flows often occur and cause damages (like in 1995-1996, along the access road to the site) and real catastrophes (such as the one in 2004, when the day after Easter a channelized debris flow produced eleven casualties in Aguas Calientes, the close tourist town). A more general approach to the instability conditions of the site was undertaken in 2002, with the start of an international project, coordinated by K. Sassa and carried out in the framework of the activity of the International Consortium on Landslides. As constituent of this project, an integrate study of the instability condition of the debris, weathered in different ways, was established: in this work the preliminary results of the field survey and the analysis of some VHR satellite images are shown. In particular, the field survey is aimed to: a) a detailed geomorphological mapping of the area, with a special attention to the distinction between past and present phenomena and between shallow and deep landslides; b) the detection of the debris presence, and the assessment of its rheological and geometric features, as thickness of deposits, weathering level and others. This characterization allows to determine a zoning of the debris, which is useful for an accurate analysis and

a further slope instability modelling. The field data interpretation was integrated together with the analysis of some VHR satellite images. Thus, a multitemporal analysis of Quickbird panchromatic and multispectral data was carried out: an archive image dated 18 June 2002 was available while a new acquisition was scheduled from middle April 2004 and a good image was obtained on 18 May 2004. The recognition of debris flows was the main purpose of the analysis and interpretation of the images: it involved important aspects such as the size of the features, their texture in the image and the variety of forms, the contrast as difference in spectral characteristics between landslides and surroundings. Both the aspects and the potentiality of their integration were approached in this work and the results constitute the first step for an exhaustive debris flow hazard assessment in this area, where the interactions between slope instability and land use can produce some very critical conditions.